الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research
National School of Cybersecurity
Department of Foundation Training

وزارة التعليم العالي والبحث العلمي
المدرسة الوطنية العليا في الأمن السيبراني
قسم التكوين القاعدي

Material: Algorithms and Dynamic Data Structures

Academic Year: 2024/2025 **Level:** 1st Year

Tutorial/Practical work 04: Recursion

Exercise 01: Recursion on Dynamic Data Structure (DDS)

- Write a recursive module to search for an element in DDS.
- Write a recursive module to display the contents of a linked list, a queue, and a stack.
- Write a recursive module to inverse the studied DDS (linked lists, Queues, Stacks). Note that the reversion is done directly on the original DDS, without any other intermediary data structure.
- Write a recursive module to sort a DDS.
- Write a recursive module for DDS Union and intersection.

Exercise 02: Recursion on Strings

- Write a recursive module that takes a string as an input and returns its length as output.
- Write a recursive module that takes a string as an input and returns the number of consonants as output.
- Write a recursive module that takes an array of characters as an input and returns all possible combinations using these chars (generation of passwords).

Exercise 03: Recursion on Arrays

- Write a recursive module that computes the sum of an array.
- Write a recursive module that finds the max and min of an array.
- Write a recursive module that gives the max length of a palindrome in a given array.
- Write a recursive module that returns the reverse of an array.
- Write a recursive module that gives all subsets of a given array; for example:
  - **Input:** arr = [1, 2, 3].
  - **Output:** {{}, {1}, {1, 2}, {1, 2, 3}, {1, 3}, {2}, {2, 3}, {3}}.